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From rags to riches? Intergenerational transmission of income in Europe

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From Rags to Riches? Intergenerational Transmission of Income in Europe*

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Abstract — The paper uses data from the European Union Statistics on Income and Living Conditions (EU-SILC) 2005 to analyze intergenerational income mobility in Austria compared to other European Union members. Applying various methodological approaches like least squares estimations and quantile regressions we reveal substantial differences in intergenerational mobility between Scandinavian countries and Continental Europe. The results show that income class rigidities in most European countries are striking compared to the Nordic countries.

Keywords: Intergenerational Income Mobility, Income Distribution, European Union

JEL-Classification: D30, E24, J62

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1. Introduction

There is a broad consensus in society regarding the possibility of a so-called rise from rags to riches. It is widely thought to be indisputable that certain individual effort almost automatically leads to social and economic advancement. However, the *OECD* (2008, p. 204) states, that "many OECD countries are rightly concerned about intergenerational mobility - the extent of transmission of advantages or disadvantages across generations. When children 'inherit' a substantial degree of their economic status or other important social characteristics from their parents, this generates widespread perceptions of unfairness and lack of opportunity. Societies characterised by a high transmission of social and economic status from generation to generation are mostly perceived as unfair". It is therefor of great interest to find out if the social status of an individual is determined by the economic or social situation of his/her ancestors, and to what extent that might be the case. If it turns out that wages are independent between generations and income is not predetermined by one's parental economic status, this outcome would support the view of "equality of opportunity". From a sociological as well as an economic perspective, limited social mobility implies loss of efficiency, since children from socially disadvantaged families hardly have access to the market of so-called high potentials even though they might have specialized skills. Resources would therefore not be deployed adequately, a result which has social and political consequences.

The present analysis concentrates on the financial sphere of intergenerational transfers, therefore making the suitable denomination of the object of investigation the *intergenerational transmission of income* rather than *social mobility*. Our main focus lies on distributional issues such as the analysis of mobility differences on different parts of the income distribution.

This paper is structured as follows: In section 2 we provide a short literature survey. Although previous studies emphasize mobility in the United States, we concentrate on literature based on European countries, since our main focus lies on the European Union. TThe bulk of articles deals with data problems regarding the investigation of intergenerational mobility as well as nonlinearities in the measurement of intergenerational transmissions of income. This segues into section 3's discussion of our data, where we describe the European Union Statistics on Income and Living Conditions (EU-SILC) as well as issues concerning sample selection. In Section 4 we elaborate several methods for the analysis of intergenerational mobility such as income elasticities and quantile regression approaches. We give particular attention to the critique of these methods in the relevant literature. Finally we present the main results in section 5. Section 6 concludes and discusses some policy implications.

2. Literature At A Glance

While the current state of research on intergenerational mobility in most European countries is extremely weak, there has been a plethora of research on an international scale. *Mulligan* (1999, p. 187) presents a detailed list of articles concerning intergenerational mobility across several topics (see Table 1). 16 articles among them deal with earnings or wages and estimate income elasticities[1] between 0.11 and 0.59 and an average value of 0.34. *Solon* (2002) lists twelve articles concerning intergenerational mobility in countries other than the United States. He refers to studies in Canada, Finland, Germany, Malaysia, South Africa, Sweden and the United Kingdom which find mobility measures between fathers and sons with elasticity values between 0.11 (Germany) and 0.57 (United Kingdom). Most of these elasticity coefficients are calculated by least square estimates of a log-linear regression with age controls for both generations.

Table 1: Studies of Intergenerational Mobility

Economic Characteristic	Number of Estimates	Range	Average
1. Years of schooling	8	.14-.45	.29
2. Log earnings or wages	16	.11-.59	.34
3. Log family income	10	.14-.65	.43
4. Log family wealth	9	.27-.76	.50
5. Log family consumption	2	.59-.77	.68

(Source: *Mulligan* 1999, p. 187)

One in depth study of intergenerational transmission of income comes from the case of Sweden, where *Österberg* (2000) analyses tax-data files to examine intergenerational transmissions of earnings status. Österberg uses data from the Swedish Income Panel, which consists of a representative one percent sample drawn from the register of the total population. The information on income was gathered in two different periods, each lasting three years (1978 to 1980 for the parents and 1990 to 1992 for the children). This separation leads to varying mean ages for parents (fathers: 52, mothers: 49) and children (37) at the point of observation. The author concentrates on regression results as well as on transition matrices with respect to gender and compares his results with the work of *Björklund/Jäntti* (1997). Österberg reports high intergenerational income mobility in Sweden compared to estimates from most other countries. He derives correlation values varying between 0.11 and 0.18, depending on different restrictions. *Jäntti* et al. (2006) calculate a correlation of 0.14 for Sweden which is rather similar to Österberg's results.

Schnitzlein (2008) provides a collection of several studies on intergenerational income mobility carried out between 1997 and 2006 in Germany. He presents an overview of the income elasticity between fathers and sons. According to the referred authors, observed intergenerational mobility is higher in Germany than in the United States. However, this finding is on the basis of very few studies and the conclusions should therefore not be taken as incontrovertible. Schnitzlein produces estimates of intergenerational income elasticity values for Germany between 0.10 and 0.37, which means that a marginal increase in the logarithmic income of parents by one unit leads to an increase in the descendant's logarithmic income of between 0.10 and 0.37 units. These positive regression coefficients

[1] Most empirical analysis is based on a simple regression equation, denoted by

$$ln\, Y_{i,t} = \alpha + \beta \cdot ln\, Y_{i,s} + \epsilon_{i,t}$$

where $ln\, Y_{i,t}$ is the logarithmic life time income of a descendant of family i. This is determined by the average income of his generation α, a noise term $\epsilon_{i,t}$ and the influence of the parental logarithmic income of his parents $ln\, Y_{i,s}$. The coefficient β measures the income elasticity between two generations (see *Corak* 2004, p. 10).

may be interpreted as a positive relationship between earnings of fathers and sons, and hence limited income mobility.

Zimmerman (1992) cites several studies for income elasticity in the United States. These studies revealed that the elasticity coefficients of children's earnings with respect to parent's earnings are between 0.15 and 0.45. Zimmerman himself estimates the elasticity of descendant's earnings with respect to parental income to be 0.4. However, *Mazumder* (2005) argues that due to persistent transitory fluctuations these estimates have been biased down by approximately 30% and instead calculates an intergenerational earnings elasticity (IGE) of around 0.6 for the United States. From a vast pool of studies on intergenerational income mobility, other relevant literature has been provided by *Vogel* (2006) and *Schäfer/Schmidt* (2009) for Germany, *Kopczuk/Saez/Song* (2010) for the United States, *Atkinson* (1981) and *Dearden/Machin/Reed* (1997) for United Kingdom, *Björklund/Jäntti* (1997) for Sweden as well as *Corak/Heiz* (1996) for the case of Canada, and *OECD* (2010) and *Causa/Dantan/Johansson* (2009) for European OECD countries. Extensive work on North America and Europe has been published in a volume edited by *Corak* (2004). One of the most recent surveys on IGEs and their causal mechanisms has been conducted by *Black/Devereux* (2010).

Although cross-country comparisons of IGEs may provide a first clue of the main differences between countries, such comparisons can be misleading – particularly if elasticities differ across quantiles of the income or earnings distribution. If we focus on the lower part of the income distribution we are studying the "stickiness" of poverty, whilst in the upper tail our concern is on the "stickiness" of wealth. Since both transmission mechanisms and policy conclusions will be entirely different for either tail of the distribution, it is necessary to analyze overall IGEs specifically by quantiles. In other words, it is imperative to take care of nonlinearities. A brief literature survey on nonlinearities in the intergenerational transmission setting is presented in the following section.

2.1. Literature on Nonlinearities

As far as the authors know, the issue of nonlinearities in intergenerational earnings mobility was raised for the first time by the doyen of distribution theory, Sir Tony Atkinson, nearly thirty years ago:

> "The proportion of upwardly mobile sons from the bottom 20 percent appears to be considerably higher and the proportion of downwardly mobile sons from the top 20 percent appears to be lower."
> *Atkinson/Maynard/Trinder* (1983, p. 114)

Most of the earlier studies which consider the issue of nonlinearity have done so in order to test the conjecture of *Becker/Tomes* (1986) which would imply a concave relationship between the earnings of parents and their descendants. This conjecture has been verified by some studies (e.g. *Eide/Showalter* 1999). Several other studies provided evidence for (more) convex patterns (e.g. *Corak/Heisz* 1999, *Bratsberg* et al. 2007, *Björklund/Jäntti* 1997, *Björklund/Roine/Waldenström* 2010). However, aggregation of the relationship between the earnings of parents and their children (concave vs. convex vs. linear) is rather crude, and we have to be cautious — it is only by studying the details of the functional form of IGE that we can offer more conclusive results.

Studies testing nonlinearity use either ordinary least squares regression (OLS), transition matrices, instrumental variables (IV) or quantile regression techniques. Most of these studies have been carried out for the U.S. and U.K. Later on, studies for Canada, Australia and the Scandinavian countries have been done. Many of these studies have demonstrated particular asymmetries for the bottom and top fractiles of parent's earnings: upward mobility from the bottom is more likely than downward mobility from the top. However, these asymmetries differ quite a lot between countries.

In his seminal paper on intergenerational mobility for the U.S., *Solon* (1992) focuses explicitly on nonlinearity. He tries to capture nonlinearity by adding the square of father's log earnings. However, even if he provides some evidence for nonlinearity, the study's small sample size (just 348 father-son pairs) limits the ability to give evidence for statistical significance.

Corak/Heisz (1999) provide a significant empirical analysis with a very large data sample from Canada. They analyze IGEs with a data sample drawn from tax records of 400,000 father-son pairs. They provide evidence for high mobility in the middle of the distribution and low mobility in the tails. Importantly, they also present conclusive evidence that earnings mobility is far greater than income mobility. For the top-income group IGEs were 0.4 and 0.8 for earnings and income, respectively. Large differences in IGEs by earnings and income is also substantiated by *Björklund/Roine/Waldenström* (2010).

Mazumder (2005) offers a very accurate study on the impact of wealth on IGE. First, he shows convincingly that by using variables which give a better indication of life-long income, the IGE for the U.S. increases from former estimates of 0.4 (*Solon* 1992, *Zimmerman* 1992) up to 0.6. Furthermore, he splits his data samples into two and four respectively equally large sub-groups and estimates IGEs for each sub-sample. He finds strong evidence that the richer half of his sample is more mobile than those below median wealth. Although he is rather cautious with the interpretation of his results, he concludes that an obvious candidate for policymakers could be promotion of greater educational attainment among poorer households. However, to specify the functional form of IGEs we have to analyze IGEs at smaller sub-samples than halves or quarters. For that reason, very large data samples are absolutely vital to these studies.

A different approach is performed by *Grawe* (2004). He uses Canadian tax data with 56,141 father-son pairs. Grawe introduces a new theoretical interpretation of nonlinearities: he argues that the existence of credit constraints is neither a necessary nor a sufficient condition for nonlinearities in intergenerational mobility as long as IGEs depend, inter alia, on the nature of the earnings function. If this is the case, international comparisons of intergenerational earnings mobility might be more complex. In particular, the nature of the functional form in the relationship of an IGE is likely to vary across countries with the nature of earnings relationships as well as with differences in factors relating to financial markets, human capital acquisition and public policy. However, testing such hypotheses might be troublesome *Black/Devereux* (2010).

Jäntti et al. (2006) also use transition matrices to estimate mobility by quintiles for the U.K., U.S., Denmark, Norway and Finland. They find that persistence is most pronounced in the tails of the distribution whilst mobility between the middle three quintiles is fairly similar across all five countries. Persistence in the top is strong in all five countries. However, mobility from the lowest quintile is found to be much higher in Norway and Denmark. Interestingly, they find that the much larger IGE in the U.S. and U.K. compared to the Nordic countries is almost entirely due to differences in the tails. In particular, the U.S. and U.K. exhibit a lower top-down mobility than the Nordic countries. Additionally, and in contrast to the Nordic countries, the U.S. exhibits strong persistence at the bottom of the income distribution. Due to these peculiarities of the U.S. they call this result "American exceptionalism".

Another seminal contribution to the discussion of the importance of nonlinearity in IGEs is *Bratsberg* et al. (2007). They use a dataset with more than 280,000 observations to test for nonlinearities and compare the U.S., U.K., Denmark, Finland and Norway. Their results provide evidence that the IGE is close to linear for father's income in the U.S. and U.K. while the pattern is convex in the three Nordic countries. Also there results testify strong intergenerational persistence at the top of the income distribution for Denmark, Finland and Norway. They argue that this is due to the educational systems in Nordic countries, which ensure equal educational standards for all citizens.

Looking at the U.S., *Kopczuk/Saez/Song* (2010) explore not only short-term fluctuations but also the evolution of mobility and inequality over a lifetime. They show quite convincingly that mobility at the top of the earnings distribution has been very stable since 1978; the probability of staying in the top one percentile remains between 65% and 80%. Even the surge in top earnings since 1985 has not been accomplished by increased mobility at the top. Mobility on the lower side of the income distribution is different. The relatively stable mobility of total population for the bottom two quintiles (P0 – P40) over the period 1950-1980 hides strong heterogeneity by gender groups: while men show slightly declining long-term mobility, women display strong upward-mobility mainly due to their strong economic progress. *Hertz* (2005) provides a convincing graphical illustration of different mobilities among diverse income groups. Although the intergenerational correlation of incomes in his data set for the U.S. is only 0.42, the differences in the likely life trajectories of the children of the poor and the rich are substantial. In particular those at the tails, i.e. those stuck in either poverty or affluence, do exhibit much stronger persistence. For example, a child born to the top decile has a 43.3 percent chance of attaining the top quintile. In contrast, the child of the poorest decile has a 4.3 percent chance of attaining the top quintile. The immobility on the lower tail is even larger. Children of the poorest decile have a 51.3 percent chance of occupying the lowest quintile, while those from the richest decile have only a 3.5 percent chance of ending up there. Additionally, mobility patterns differ dramatically by race. In particular, persistence in the bottom decile is much higher for blacks than for whites. In a similar vein *Bowles/Gintis* (2002) argue that the main explanation for strong persistence at the top is related to the fact that children of well-off parents obtain more and higher quality schooling. Additionally, wealth inheritance makes an important contribution for the persistence at the top. Since low wealth and low educational attainment is strongly correlated with blacks this is not surprising.

Rather recently, *Björklund/Roine/Waldenström* (2010) presented an investigation on IGEs for the top of the distribution for Sweden. They analyze a data sample with 100,000 father-sons pairs and find that it is crucial to study small fractions in the top of the distribution to get a clear picture of income mobility. They find that Sweden, although a country which is known for having relatively high intergenerational mobility in general, is a society where intergenerational transmission remains strong in the very top of the distribution. Similar to *Bowles/Gintis* (2002) they find that wealth is the most likely channel for such strong persistence.

Recently, the first studies on intergenerational mobility with EU-SILC data were conducted (*Esping-Andersen/Wagner* 2010, *Causa/Dantan/Johansson* 2009). As explained below in more detail, these are standardized data for the 27 countries in the EU. *Esping-Andersen/Wagner* (2010) focus on five countries – Denmark, Norway, Italy, Spain and France – and find substantially greater mobility in Scandinavia. They say that this difference is primarily due to a 'bottom-up' process of equalization; as they show, the advantages associated with coming from highly advantaged origins are quite persistent. Like *Björklund/Roine/Waldenström* (2010) they conclude that the advantages related to privileged origins persist also in the two Nordic countries. *Causa/Dantan/Johansson* (2009) provide comparable estimates of intergenerational wage and education persistence across 14 European OECD countries. Their data also suggest that persistence is higher in the tails and in particular at the top. However, they measure persistence in wages in relation to father's education and not with respect to father's earnings, as we do. They suggest that financial constraints might hinder disadvantaged parents from investing in high ability children's education.

To conclude, although there are quite a few international studies on nonlinearities, empirical research with standardized data for the EU is rare. At least to our knowledge with the exception of the two mentioned studies by *Causa/Dantan/Johansson* (2009) and *Esping-Andersen/Wagner* (2010) no cross-country comparison on nonlinearities for the EU exists. We want to fill this gap with the present study.

3. Data

3.1. Data specification

There are several challenging issues concerning the measurement of intergenerational mobility. The most evident problem is the lack of appropriate data, since most countries do not have data on income for two related generations. Even if some information on income for multiple regions is available, there could be severe inconveniences comparing observations across countries. To our knowledge, there is only scarce data to analyze the intergenerational transmission of income in the European Union and none available for a precise comparison across regions. *Björklund/Jäntti* (1997), for instance, had to estimate intergenerational income correlations for independent fathers and sons, because income data for related generations were not available for Sweden. Their technique was based on predictions of progenitors' earnings given their education and occupational status[2]. The same procedure is applied by *Andrews/Leigh* (2009) due to the lack of data. The authors approximate hourly wages by a regression on a vector of dummies for occupation and age. The earnings of fathers in a certain occupation is then predicted to be the same as those of a 40 year old man in this profession. In his article on Germany, *Schnitzlein* (2008) points out, that there are no existing data that contain long term (or at best life time) earnings for two interconnected generations. For this reason, economists find a remedy in approximations via annual observation time series[3].

For most European countries no Census data on monetary income for two related generations is available. Consequently, the only practicable method to investigate intergenerational income mobility is the usage of survey data that include questions concerning the financial situation of a respondent's ancestors. The European Union Statistics on Income and Living Conditions (EU-SILC) provides such data in its 2005 questionnaire and again in the 2011 panel wave. The EU-SILC is a survey carried out in private households with a central focus on income, employment, living, health and financial conditions. The sample population is made up of households with at least one household member aged 16 or older. The EU-SILC questionnaire replaced the European Community Household Panel (ECHP). Since the last panel wave of the ECHP in 2001, no data on income and living conditions were collected on a European scale[4]. The EU-SILC project was started in 2003 to pursue the objective of a standardized survey for comparable analysis of economic conditions in European households.

As far as the income level of parents in the EU-SILC 2005 is concerned, a relevant question asks whether there were financial problems in the respondent's household when he/she was aged 12 to 16 years old. Responses were classified into five levels between *most of the time* to *never*. In some countries (e.g. Austria) the equivalent question asks how the respondent would characterize the financial situation of the household from age 12 to 16 (5 response categories from *very good* to *very bad*). Consequently, our approximation for wealth and income status of parents will come from the five categorical responses to these questions, where a value of *one* means very bad financial conditions and *five* means very good income status.

However, retrospective questioning of descendants is often not accurate in determining parental income, since the reference date in questionnaires varies widely for different age groups. In general, estimations of the former income of parents that date back a long time are less valid than recent time periods[5]. As a consequence, the estimations of elder participants in such surveys may be less solid than those of younger respondents[6]. For instance, Figure 1 shows for the case of Austria, respondents over 45 years of age tend to declare their parental household *poor* (26.3% compared to 14.4%) or *very poor* (6.9% to 3.8%) more often than younger interviewees, whereas the median category in both group is most often picked. The Spearman rank correlation coefficient between age and the parental financial status is $-0.234\,(p = 0.00)$ and indicates a negative relationship

[2] *Österberg* (2000, p. 422)
[3] Problems and potential biases are discussed by *Becker/Tomes* (1986) and *Zimmerman* (1992).
[4] *Statistik Austria* (2007b, p. 5)
[5] cp. *Statistik Austria* (2007a, p. 59-60)
[6] *Couch/Dunn* (1997, p. 220) show that downward biases may be reduced by raising the cutoff age to 25, resulting in higher correlation coefficients.

between age and parental income.

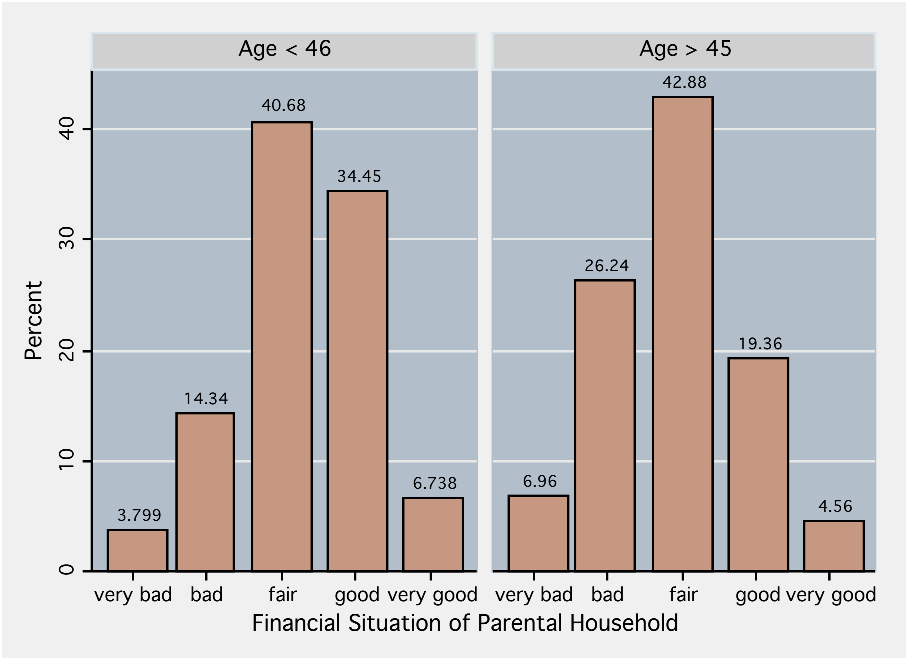


Figure 1: Parental Income for Age Groups in Austria

Aside from the main problem of the retrospective questioning, there is another problem that comes up in survey data with respect to the income of respondents. Contrary to official data from tax or social insurance authorities, information on income in questionnaires cannot be verified. Statisticians have to assume that respondents declare their real incomes, which could lead to substantial biases if the assumption is violated. Especially at the ends of the income distribution, there could be a tendency to over- or understate one's income. However, although these measurement problems are quite critical, they are less of a concern for cross-country comparisons, because there is no reason to suspect that the biases would be systematically different by country.

Unfortunately not all countries participating in the EU-SILC offer data on the parental income status, since this question was not obligatory according to the SILC regulations. We are therefore able to include 20 European Union countries - Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Spain, Finland, France, Hungary, Ireland, Italy, Lithuania, Luxembourg, Netherlands, Poland, Sweden, Slovenia, Slovakia and the United Kingdom as well as Iceland and Norway as non-members - into our calculations. Due to the lack of data for Bulgaria, Germany, Greece, Malta, Latvia, Portugal and Romania these European Union members could not be included into the analysis.

3.2. The EU-SILC 2005 income data

There are several variables regarding an individual's income collected in the EU-SILC 2005[7]. The reference period for the declaration of all income components was the calendar

[7] For a detailed list see *European Parliament* (2003, p. 3).

year 2004, and all income data was collected on an annual or on a monthly basis. If respondents could not or were not willing to reveal their exact income, they were asked to point to a certain level on an income range chart[8]. However, several values were missing in the raw data. Missing net income values were imputed in EU-SILC and missing gross income values were computed using net-gross-conversion.

(a) Gender

(b) Age

FIGURE 2: MEAN WAGE WITH RESPECT TO PARENTAL INCOME CLASS IN AUSTRIA FOR GENDER AND AGE

The dependent variable in this analysis is the gross hourly wages of employed individuals[9]. Most respondents declare their work time per week, allowing us to calculate the annualized wages on a weekly and an hourly basis. These calculations are based on wages and salaries paid in cash for time worked in main and any secondary job including holiday pay and any additional payments during the year preceding the interview. For those observations for which monthly wages in 2005 were available, we updated the 2004 data to reflect the 2005 figures. Finally, we derived the logarithmic hourly wages. While other studies (e.g. *Österberg* 2000) lack data for working time, the EU-SILC is equipped with data on working hours per week, and we are therefore able to correct for potential working time biases. By way of example, Figure 2 presents the (gross) mean hourly wages for Austria for all observations by gender as well as by age, given the particular parental income status from *very poor* (1) to *very good* (5). The mean wage is clearly increasing with the financial situation of the parental household. This is true over both age and gender. Remarkably, the income gaps between male and female as well as young and old respondents at both tails of the distribution vary significantly.

[8]The gross monthly income was categorized into 15 classes ranging from "1-600" to "8,001 and more" euros. For instance, 47 percent seized the possibility to declare their income out of investments (dividends, savings book, building loan contract, stocks and bonds, etc.) by the classification in categories. The alternative to such charts would be probably increase the rate of non-responses, resulting in a loss of important information on income

[9]Note: "This may potentially exaggerate the degree of intergenerational wage mobility, to the extent that the offspring of higher-educated families are less likely to be inactive than the offspring of low-educated families." (*Causa/Dantan/Johansson* 2009, p. 10)

4. The Measurement of Intergenerational Transmission of Income

In this article we will focus on two methodological approaches to analyze intergenerational mobility. In Section 4.1 we briefly address to simple correlation statistics and in Sections 4.2 and 4.3 we will focus on an econometric approach. All of these measures are used in the relevant literature and are discussed widely[10].

4.1. Spearman Correlation Coefficient

Since parental income in the EU-SILC 2005 is not provided as a floating variable but rather as a ranked proxy, the common Pearson correlation coefficient is not capable of measuring the relationship between parental and descendant incomes. Instead we use the Spearman rank correlation coefficient, better known as Spearman's Rho. The correlation coefficient is given by

$$\rho = \frac{\sum_i (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_i (x_i - \bar{x})^2 \sum_i (y_i - \bar{y})^2}},$$

where x_i and y_i are the ranks. In our case, we are going to calculate the Spearman's Rho for the relationship between individuals' earnings and parental income status. One particular problem that arises with this approach is the loss of control for age. The correlation coefficient is only able to capture the direct relationship between the two variables, but can't take into account that wages could rise with the age of an individual. This issue will be handled with least squares regressions

4.2. Model Specification

The common approach to intergenerational income transitions is the calculation of the regression coefficient β_1 of the corresponding parental income to the income of descendants. Hence, the basic model yields

$$ln\, Y_{i,t} = \alpha + \beta_1 \cdot ln\, Y_{i,s} + \epsilon_{i,t} \tag{1}$$

where $Y_{i,t}$ is the logarithmic income of a descendant, $Y_{i,s}$ is the wage of the parents and ϵ_i is a *white-noise* error term. The coefficient β_1 may be denoted as the intergenerational income elasticity[11]. Perfect mobility would be attained with a coefficient value of *zero*, whereas a value of *one* would report perfect immobility[12]. Values close to unity are indicative of limited mobility.

[10] See *Fields/Ok* 1996, *Zimmerman* 1992

[11] See *Zimmerman* (1992), *Vogel* (2006), *Björklund/Jäntti* (2009), *Schnitzlein* (2008), etc.

[12] An important constraint of this approach is given by *Anderson/Leo* (2009). The authors refer to the implicit assumption that y and x are homogeneously linear across all socioeconomic strata. If they were not, one could incorrectly interpret zero correlation as perfect mobility: "Imagine a deterministic world (perfectly immobile) where below a certain parental income there is an exact negative relationship between parent and child outcomes, whereas above that income there is an exact positive relationship between parent and child outcomes; an appropriately balanced sample would yield 0 correlation with an inferred perfect mobility for what is a completely deterministic and immobile state." (*Anderson/Leo* 2009, p. 621)

The basic equation used in this paper denotes

$$lnY = \beta_0 + \beta_1 X + \beta_2 P + \epsilon \tag{2}$$

where X is a set of *Mincerian*[13] offspring characteristics affecting wages. Due to the fact that lifetime earnings may not be derived with the data at hand, the most important control variable in the matrix is the age of an individual[14]. Furthermore X contains dummies for gender, marital status, a managerial position, the company size (more than 50 employees), immigration and a graduation at university. P in Equation (2) counts for several observed parental characteristics, like education, skill levels or lone parenthood.

In the extended version of Equation (2), dummies for the particular parental income status are added as parental income dummies (PID).

$$PID_i = \begin{cases} 1, & \text{if parental income status is } i \\ 0, & \text{otherwise,} \end{cases}$$

where i is one of the five income classes between *very good* and *very bad* (or 1 to 5 respectively). Finally we derive our extended regression Equation (3) consisting of the individual endowment matrix X, parental characteristics matrix P and the parental income dummies PID_2 to PID_5 (where PID_1 is the *nummeraire*). The coefficients β_3 to β_6 indicate a change in the logarithmic hourly wages, given a certain parental income status compared to the initial situation of a *very bad* financial situation. The interpretation therefore is always in relation to the worst financial situation and consequently the coefficients are expected to be above zero.

$$lnY = \beta_0 + \beta_1 X + \beta_2 P + \beta_3 PID_2 + \beta_4 PID_3 + \beta_5 PID_4 + \beta_6 PID_5 + \epsilon \tag{3}$$

As has been shown already in Section 2.1., many studies on intergenerational transmission of income report evidence of lower mobility at the tails of the earnings distribution. It is obvious that class rigidities increase the inheritance of poverty across generations. To obtain a more detailed picture of intergenerational mobility, we control whether income elasticity differs with a movement along the income distribution path. An appropriate way is to derive quantile regressions at different percentiles of the distribution[15]. The elasticity values at arbitrary percentiles θ can be derived by

$$\min_{\beta \in R^k} \left[\sum_{i \in \{i: Y_{i,t} \geq x_{i,t}\beta\}} \theta |Y_{i,t} - X_{i,t}\beta| + \sum_{i \in \{i: Y_{i,t} < x_{i,t}\beta\}} (1-\theta) |Y_{i,t} - X_{i,t}\beta| \right] \tag{4}$$

[13]See *Causa/Dantan/Johansson* (2009, p. 8)
[14]See *Solon* (1992, p. 399)
[15]For a detailed introduction into quantile regressions see *Koenker/Hallock* (2001); for its application see *Koenker* (2010)

where $Y_{i,t}$ is the dependent variable, $X_{i,t}$ is the vector of explaining characteristics and β is the vector of estimated coefficients. Using the methodic framework of quantile regressions we should be able to reveal non-linear characteristics of intergenerational transmissions of income.

4.3. Critical Remarks on OLS methods

A cautious approach to OLS coefficients of income variables is recommended by *Zimmerman* (1992). According to him, there are potential life-cycle biases caused by the arbitrary date of observation of the sample. The most decisive problem is the particular time of the data acquisition[16]. It is not possible to reveal whether a descendant, aged 20, draws a lower salary due to a low life-span income or due to the recent career entry. If the latter is true, the person could certainly be in another position in the income distribution if asked 15 years later. Ideally, income data would be available over the entire working lives of parents and descendants respectively. Beyond these distortions, short-term proxies for lifetime economic status, such as annual earnings could be influenced by transitory fluctuations. This measurement error could lead to a higher variance of the observed value than that of the underlying life-cycle value and consequently result in downward-biased OLS-coefficients (see *Mazumder* 2005).

Another caution is given by *Corak* (2004, p. 11), who points out that there is a difference between *income elasticity* and *income advantage* when the earnings distribution for the parental generation is unequal. He argues that even small elasticity coefficients may indicate substantial income advantages for children, depending on the degree of inequality in the parental earnings distribution. *Björklund/ Jäntti* (2009, p. 497) discuss this issue as well. They argue that the OLS-coefficient depends on income dispersion in two generations. Thus, if income inequality rises from one generation to another, a larger coefficient will be needed to account for the increased income variation in the second generation. Consequently, an elasticity coefficient multiplied by the ratio of the standard deviations of parental and descendant income should be preferred, namely $\varphi = \beta(\sigma_f/\sigma_s)$. This correlation coefficient provides information how many standard deviations the child's wage would change with a modification in the standard deviation of the parental income.

O'Neill/ Sweetman/ Van de Gaer (2007, p. 160) focus on measurement errors in least squares estimations: "Omitted variable bias [...] occurs when unobserved characteristics that are inherited from parents, such as ability, are also correlated with earnings. The OLS estimator mistakenly attributes the variation in earnings due to inherited endowments directly to parental earnings, leading us to overestimate the causal effect of parental earnings on children's earnings. While the simple linear regression model provides a useful summary of the conditional mean function, it is only a partial description of the joint distribution of earnings. When considering intergenerational mobility patterns throughout the distribution, researchers have traditionally moved away from regression based models and relied instead upon transition matrices."

According to this critique as well as to the problems of on nonlinearities which were

[16] *Schnitzlein* (2008, p. 12), *Zimmerman* (1992, p. 411)

discussed in Section 2.1, we proceed as follows: First, we perform simple correlation statistics for offspring and parental income for all 22 countries under consideration and discuss the preliminary findings. We then estimate several OLS equations with variables for the individual, the employer, and the parental situation as along with interaction terms. Additionally, we add dummies for the financial situation of the respondent's parents. Since we find significant effects for these dummies, we perform quantile regressions in which quantiles of the conditional distribution of actual incomes are expressed as functions of parental incomes.

5. Main Findings

5.1. Correlation Statistics

In Figure 3 the Spearman rank correlation coefficients for actual (logarithmic) income of descendants and the parental income status are illustrated. All values are significant at a 5%-level except the one for Denmark, which shows the lowest correlation. The Northern European states display the smallest relationship between the parental and the offspring's earnings. The data reveals that Denmark, Finland, the Netherlands, Sweden, Iceland and Norway exhibit lower correlation than Central European countries like Italy, Austria, Spain or in the extreme case of Luxembourg. For comparison,we refer to the *OECD* (2010, p. 185) study, which sums up various studies on intergenerational income mobility and shows strong links between individual and parental earnings in United Kingdom, Italy, USA, France, Spain and Germany. Weak relationship is seen in Denmark, Australia, Norway, Finland and Canada. We may support these results for the covered countries with the remark, that mobility in Spain is noticeable lower than in Italy or France in our calculations.

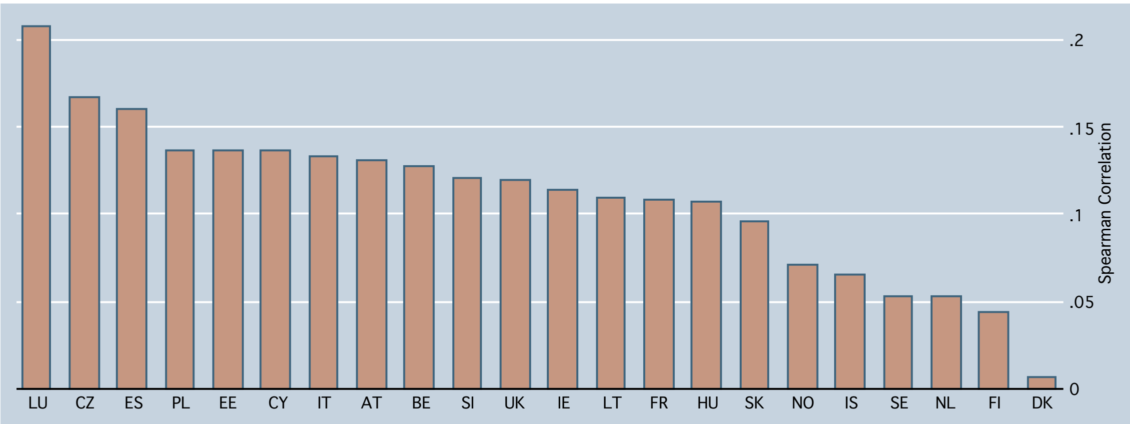


Figure 3: Spearman Correlation Coefficients between Actual and Parental Income

Fessler/Schürz/Mooslechner (2011) pointed out, that the level of educational mobility in Austria is similar to Italy or Slovenia and substantially lower than in the Netherlands, Finland or Sweden. As can be seen in Figure 3 this is accurate for the intergenerational transmission of income status as well. While Finland (0.044), the Netherlands (0.053) and Sweden (0.053) belong to the highly mobile class, Austria (0.131) may be associated with

Italy (0.133), Belgium (0.127) and Slovenia (0.121). The *OECD* (2010, p. 187) mentions education as a key driver of intergenerational persistence in wages. According to the authors, the influence of parental educational attainments on their descendant's wages could reflect social norms or work ethics transmitted to children but also the role of social networks. In Figure 4, we examine the relationship between the educational level of parents[17] and the descendant's income.

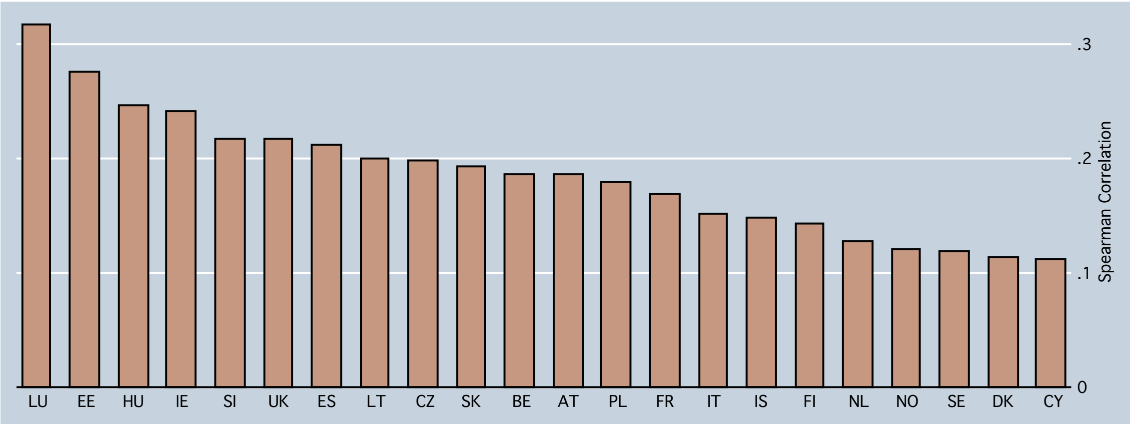


Figure 4: Spearman Correlation of Parental Education and Offspring Income

The relationship between the parental educational level and the offspring income in Scandinavian or Northern countries is significantly lower than in other European countries. Once more, Luxembourg shows the highest correlation between characteristics of parents and the income of descendants. Obviously well-educated parents have higher probabilities to have children in well-paid jobs with higher educational attainments. In Scandinavian countries children seem to be more independent with respect to parental income status and educational level. The implementation of ordinary least squares estimations should reveal the relationship in a more detailed way, especially as far as we may control for the matter of age.

5.2. Regression results

The OLS model in use was described in section 4.2 which we firstly adapt for Austria. As a first step we want detect whether there are problems of multi-collinearity within a ordinary least squares model. There are reasonable arguments that several variables (such as the educational level of descendants) could correlate with the parental income status. We could not find any severe effects of multi-collinearity by calculating the variance inflation factor (VIF). A VIF near 1 implies no multi-collinearity while a value of 5 or higher reports some problems with the variables. The mean VIF in our model equals to 2.03 which signals low risk of multi-collinearity[18].

Further, a simple F-Test reveals if at least one parental income indicator (PID) shows significant influence on the offspring's income. Our null hypothesis $H_0 : \beta_2 = \beta_3 =$

[17] The educational level of parents in these calculations is calculated by taking the highest educational attainment of the household, whether it is that of the mother or the father.

[18] Additional pairwise correlation analysis did not reveal significant multicollinearity effects.

$\beta_4 = \beta_5 = 0$ resulting from our model specified in Equation (3) may be rejected on all reasonable levels, indicating a significant influence of at least one indicator variable in the model. We therefore prefer the inclusion of the parental income indicators (See Table A.2). For comparison, we also show results for the simplified model. However, the basic model seems to be the best choice.

The estimation output for the basic model shows highly significant coefficients for nearly all explanatory variables. While gender and immigration have a negative impact on earnings, a leading position in one's company and the possession of a university degree have strong positive effects on income. Among the $PIDs$, the first is insignificant, whilst PID_3 is significant at the 10%-level and PID_4 and PID_5 are significant on a 1%-level. There is a significant income difference between descendants who declare their childhood household either *very poor* or *poor*. However, offspring with *good* or *very good* financial background earn significantly more than their *very poor* peers. This is a strong indicator that parental income *does* have an influence and intergenerational mobility is limited.

Table 2: Income Effects on Parent Status Movement

	$1 \to 2$	$1 \to 3$	$1 \to 4$	$1 \to 5$
LU	.2054***	.2639***	.3295***	.3633***
CY	.0743*	.15***	.1753***	.2185***
CZ	.0743**	.1138***	.1681***	.1866***
AT	.0451	.0598*	.1429***	.1444***
IT	.0477***	.1096***	.1235***	.1386***
ES	.0065	.0644***	.0682***	.1248***
IS	.2398	.1598	.1211	.1236
PL	.0412	.0889***	.0659***	.1141***
BE	.0359	.094***	.0736**	.1113***
UK	-.0492	.0992*	.0322	.109**
SK	.0385	.0334	.054	.0976**
NO	.1753	.0627	.0868	.0915
NL	.1099*	.0725	.0465	.085*
SI	.0263	.0528	.0017	.082
LT	.0107	.0221	.0466	.073**
SE	.0121	-.005	.0044	.0545
FR	-.0284	.0399	.0458*	.0516**
IE	-.062	.007	.0598	.0511
EE	.0013	.0706*	.075*2	.0448
HU	-.0046	.0121	.0218	.0441
DK	-.0533	-.0254	-.0121	-.0528
FI	.0832	-.0442	-.0465	-.0836

Since we are particularly interested in an international comparison of the influence of the different PIDs at an international comparison[19], we present the results for all 22 countries together in Table 2. The table shows the income effects of a movement in the parental

[19] We can calculate the influence of the various ranks in the parental distribution to descendants' earnings as a percent, since the response variable is logarithmic. Omitting the parental variable and simply regressing $\beta_0 + \beta_1 X$ would yield an income of $e^{\beta_0+\beta_1 X}$. Introducing the first of the dummy variables would lead to an income of $e^{\beta_0+\beta_1 X+\beta_2}$. β_0 captures the effects where the financial situation of the parental household was very poor, but we are also interested in the same effect on a child from a better-off parental household. The percentaged difference can be shown to be

$$\frac{e^{\beta_0+\beta_1 X+\beta_2} - e^{\beta_0+\beta_1 X}}{e^{\beta_0+\beta_1 X}} = \frac{e^{\beta_0+\beta_1 X} \cdot e^{\beta_2} - e^{\beta_0+\beta_1 X}}{e^{\beta_0+\beta_1 X}} = e^{\beta_2} - 1$$

Consequently, the percentage influence of all dummies compared to the original Equation (2) can be income situation based on the initial situation to be *very poor*. The last column shows the increase of wages if parents are very rich as opposed to being at the lowest income level.

The income effect of a parental income status movement from the lowest to the highest class on the descendant's earnings is seen as the best indicator of how mobile a wage structure is. A value of *zero* would mean that one's family background has no influence on income. In contrast, high values indicate low intergenerational mobility. As far as Nordic countries like Sweden, Norway, Denmark or Finland are concerned, the regression coefficients are entirely meaningless. Not a single one is significant on standard levels, which implies that a link between parental and offspring income cannot be verified. Austria is ranked behind Luxembourg, Cyprus and Czech Republic as one of the least mobile countries, followed by Italy, Poland and Spain.

Table 3: Quantile Regression Coefficients for Selected Countries

Austria	0.10	0.25	0.50	0.75	0.90
bad	-0.009	-0.027	-0.003	0.064	0.114**
fair	0.001	0.015	0.014	0.040***	0.138***
good	0.029	0.087***	0.119***	0.139***	0.211***
very good	0.028	0.063	0.102***	0.168***	0.321***
Finland	0.10	0.25	0.50	0.75	0.90
bad	0.172	0.064	0.042	0.026	0.026
fair	0.008	0.027	0.026	0.032	0.032
good	-0.017	0.018	0.029	0.033	0.024
very good	-0.100	0.011	0.024	0.009	0.019
Italy	0.10	0.25	0.50	0.75	0.90
bad	0.075***	0.055***	0.026***	0.036**	0.009
fair	0.125***	0.095***	0.073***	0.097***	0.098***
good	0.132***	0.108***	0.087***	0.116***	0.090***
very good	0.165***	0.125***	0.098***	0.110***	0.102***
Spain	0.10	0.25	0.50	0.75	0.90
bad	−0.056*	0.021	0.022	0.027	0.021
fair	0.031	0.037*	0.050**	0.073***	0.084**
good	0.060**	0.052**	0.072***	0.078***	0.072**
very good	0.075***	0.096***	0.116***	0.132***	0.155***
Sweden	0.10	0.25	0.50	0.75	0.90
bad	0.009	-0.025	0.004	-0.012	0.088
fair	-0.069	0.050	0.047	0.024	0.103
good	0.012	0.064	0.047**	-0.010	0.105
very good	-0.001	0.063	0.058**	0.030	0.144**

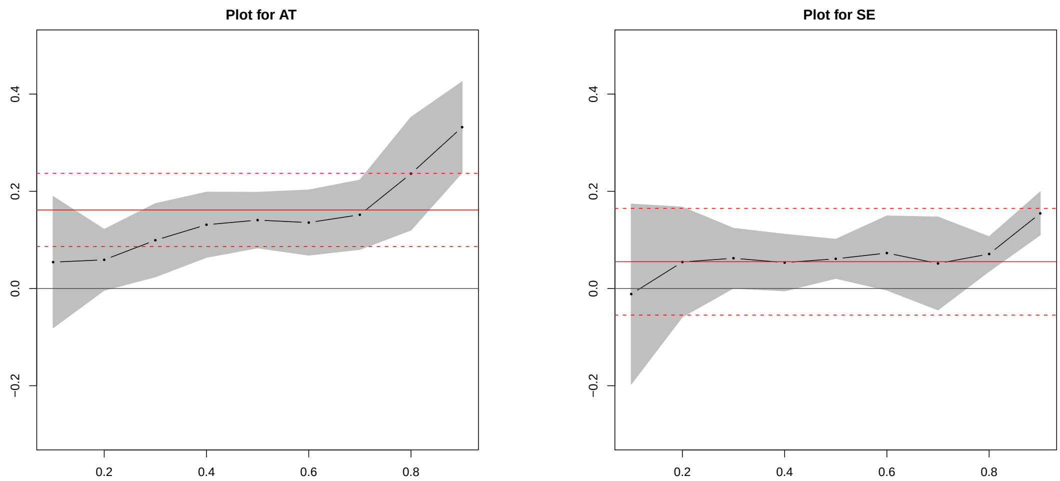
We now turn towards non-linear effects of intergenerational transmissions of income. We therefore apply quantile regression methods on our ordinary least squares estimation to reveal the effects of parental income status at particular positions in the income distribution. The results for the estimates of conditional quantile functions for selected countries are presented in Table 3. All variables from the basic model presented in Table A.2 were

measured by

$$e^{\beta_i} - 1 \qquad \forall\, i \in \{2, \cdots, 5\}$$

included into our calculations. However, in Table 3 we concentrate on the effects of the parental income class. We see here that interesting patterns emerge. Austria and Spain show stronger intergenerational transmission of income at the top quantiles; mobility in Italy is strictly limited at both tails of the distribution and Northern countries like Finland and Sweden display insignificant coefficients across all quantiles. Hence, in Austria and Spain, a higher income distribution quantile implies a stronger relationship between parental and offspring income. The significance levels show a convincing correlation of income between generations, especially for wealthier respondents, whereas in lower income groups some parental income values are insignificant. The results reveal higher intergenerational transmission of income in upper income classes. For the case of Italy, we find significant intergenerational income elasticities at all points in the distribution. Again, we cannot detect severe influence of parental income on descendants' wages in Northern European countries.

Another way to illustrate the income specific intergenerational mobility is shown in Figure 5 for the case of Austria and Sweden. The graphs show the quantile regression coefficients for a shift from the lowest to the highest parental income class. In Austria there is a steep incline of the curve, indicating a higher transmission of parental income in the upper tail of the offspring earnings distribution. Sweden shows a noticeably flatter progression, which signifies equal effects of parental income transmissions over the entire earnings distribution[20].



(a) Austria

(b) Sweden

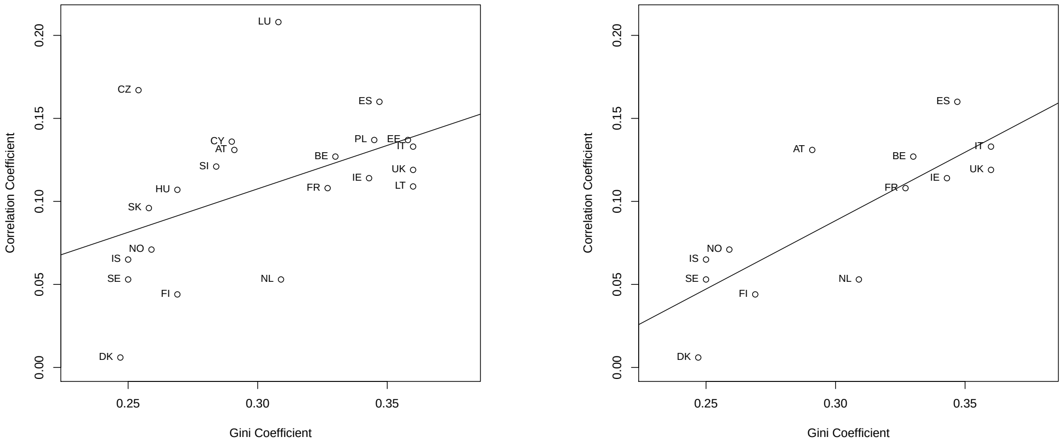
Figure 5: Quantile Regression Results for Austria and Sweden

5.3. Intergenerational Mobility and Inequality

Finally, we want to look on the relationship between inequality and mobility for the full sample of countries. *Andrews/Leigh* (2009) investigate the relationship between inequality and intergenerational mobility. By proxying father's earnings via occupational data, they reveal that sons who grew up in countries that were more unequal in the 1970s were less

[20]Figure A.1 in the Appendix provides similar graphs for all included countries.

likely to have experienced social mobility by the late 1990s. Recent research by the *OECD* (2010, p. 193) confirms that higher inequality is associated with lower intergenerational mobility. According to the authors a higher income dispersion could lead to higher returns to education and individuals whose investments to education are not limited by family background may benefit in particular. Comparing the results in Figure 6 with the figures in *Andrews/Leigh* (2009) and *OECD* (2010), the previous findings may be supported.



(a) All Countries ($R^2 = 0.23$) (b) Western ex LU ($R^2 = 0.66$)

Figure 6: Gini Coefficients and Intergenerational Income Correlation

In these figures a simple regression between the intergenerational correlation coefficient (discussed in Section 5.1) and the Gini Index[21] of the respective country is performed. In the full sample we derive a β-coefficient of 0.523 ($t = 2.45$) and a coefficient of determination $R^2 = 0.23$. In a second step we concentrate on the *old* European Union members and exclude the outlier Luxembourg as well. Now our model is able to increase the coefficient of determination to $R^2 = 0.66$ with a β-coefficient of 0.887 ($t = 4.51$). Consequently, for the countries being analyzed, the hypothesis of *Andrews/Leigh* (2009) and *OECD* (2010) can be confirmed.

6. Concluding Remarks

We have examined several indicators for intergenerational income (im)mobility of which no single study can provide a comprehensive picture. However, there are some cross-country patterns that are remarkable. In all calculations the Nordic countries (Denmark, Sweden, Norway and Finland) show substantially higher intergenerational mobility than the remaining EU-25 members under consideration. Luxembourg shows a particularly immobile social structure. Southern European countries such as Italy and Spain perform worse than the European average. An *OECD* (2010) article shows that Southern European countries along with Luxembourg appear to be relatively immobile whereas Nordic countries tend to be more mobile. In this respect our results are rather similar to those of the *OECD* (2010).

[21]Source: Human Development Report 2006 (http://hdr.undp.org/en/reports/global/hdr2006/)

The results of a quantile regression show that intergenerational transmission of income is higher and more significant in the Southern European countries. Austria and Spain show restricted social mobility, particularly in upper income classes, whereas parental income seems to be mainly meaningless for the wages of descendants in Nordic countries. Hence, in Southern European countries rich families tend to stay rich. Moreover we state that inequality and immobility are linked together. The higher the inequality in a country, the lower themobility and as a consequence, the lower the chances for social advancement.

Therefore, policies for higher social mobility should be accompanied by policies for more equal societies. According to the *OECD* (2010, p. 194), progressive tax systems and social transfer programs should not only help to make a society more equal but also strengthen the chances for individual social and economic advancement.

Individual positioning in social systems seems to result by a large extent from origin and educational status from the very beginning. In its 2006 report on "Efficiency and Equity in European education and training systems" the EU Commission states the following:

"Pre-primary education has the highest returns in terms of the social adaptation of children. Member States should invest more in pre-primary education as an effective means to establish the basis for further learning, preventing school drop-out, increasing equity of outcomes and overall skill levels."

Consequently, it is not only tax policies or social welfare systems that may account for intergenerational mobility, but basic modifications to the general educational system also seem to be decisive for more equality of opportunity. Apparently, Scandinavian countries could serve as a model worth studying for the rest of Europe also in this respect.

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A. Appendix

Table A.1: Mean Hourly Wages by Age Groups

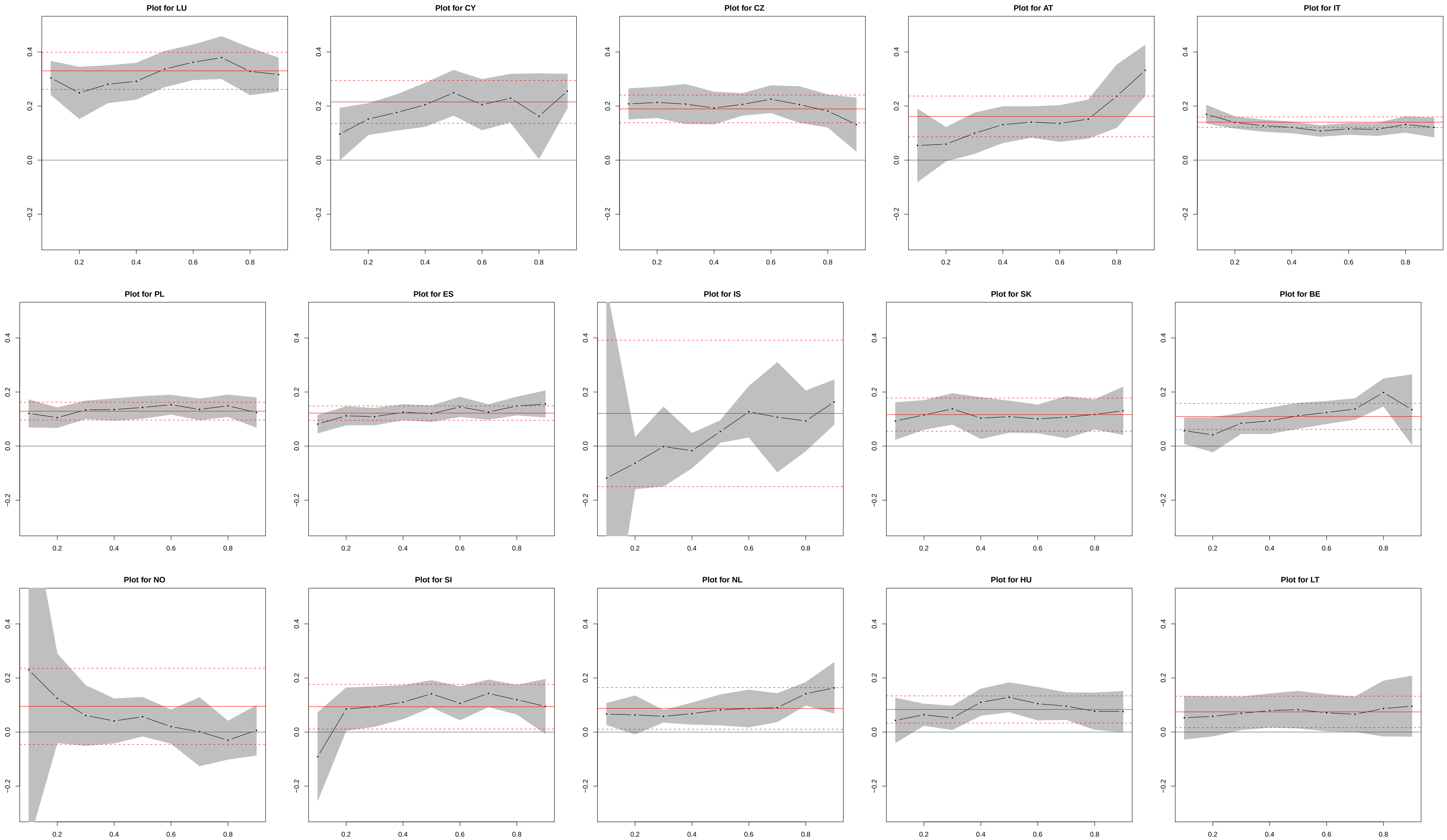
	Male			Female			Observations		
	< 35	35-44	> 44	< 35	35-44	> 44	Male	Female	Total
AT	13.16	14.77	16.49	11.56	12.26	13.93	2,185	1,039	3,224
BE	14.56	16.46	19.30	14.34	16.15	18.11	1,907	1,040	2,947
CY	8.43	10.27	12.12	7.51	8.14	9.19	1,790	1,331	3,121
CZ	3.00	3.66	3.21	2.50	2.47	2.59	1,726	1,407	3,133
DK	19.20	23.18	22.92	17.60	19.76	20.12	1,495	1,149	2,644
EE	3.02	3.13	2.59	2.20	2.16	2.04	1,712	1,743	3,455
ES	7.97	10.02	10.99	7.53	9.44	9.87	5,043	2,906	7,949
FI	13.82	16.06	17.08	12.11	13.47	13.60	1,956	1,675	3,631
FR	11.87	14.40	16.20	11.37	12.88	13.66	3,325	2,239	5,564
HU	2.61	2.63	3.14	2.30	2.38	2.62	2,374	2,092	4,466
IE	17.77	22.01	23.60	17.82	21.40	21.70	1,060	876	1,936
IS	16.95	19.02	19.76	12.99	16.88	15.57	719	502	1,221
IT	10.39	12.28	14.65	9.82	11.65	13.33	7,445	4,634	12,079
LT	2.29	2.07	2.34	1.82	1.93	2.10	1,541	1,662	3,203
LU	16.79	22.44	29.47	17.11	19.22	24.96	1,857	874	2,731
NL	16.29	20.74	23.87	16.44	18.33	19.91	1,873	468	2,341
NO	19.52	22.62	22.75	16.24	17.49	18.76	1,472	961	2,433
PL	2.24	2.58	2.68	2.23	2.55	2.64	5,034	4,448	9,482
SE	13.47	16.32	17.22	11.54	13.01	14.18	1,253	795	2,048
SI	5.65	6.63	7.32	5.50	6.86	7.28	1,709	1,526	3,235
SK	2.25	2.42	2.29	1.77	1.82	1.93	2,403	2,339	4,742
UK	18.10	20.81	21.00	16.32	17.63	14.85	1,237	984	2,221

Table A.2: Estimation Output for Austria

	Standard Model		Reduced Model		Basic Model	
Age	0.0129*	(0.007)	0.0065***	(0.001)	0.0075***	(0.001)
Age squared	-0.0001	(0.000)				
Female	-0.1589***	(0.021)	-0.1487***	(0.016)	-0.1524***	(0.016)
Married	0.0484***	(0.017)	0.0468***	(0.017)	0.0474***	(0.017)
Immigrant	-0.1064***	(0.032)	-0.1510***	(0.026)	-0.1444***	(0.026)
Female $\times$ Immigrant	-0.0709	(0.056)				
Managerial Position	0.1231***	(0.012)	0.1262***	(0.010)	0.1252***	(0.010)
Female $\times$ Managerial Position	0.0089	(0.021)				
Firm Size > 50	0.0636***	(0.016)	0.0635***	(0.016)	0.0622***	(0.016)
Lone Parenthood	0.0232	(0.026)				
University Degree Offspring	0.2816***	(0.019)	0.2949***	(0.019)	0.2866***	(0.019)
Secondary School Father	0.0400**	(0.018)	0.0539***	(0.016)	0.0457***	(0.016)
Secondary School Mother	0.0870***	(0.023)	0.1042***	(0.022)	0.0927***	(0.022)
University Degree Father	0.0575	(0.049)	0.1257***	(0.040)	0.0978**	(0.040)
University Degree Mother	0.1231*	(0.064)	0.1257**	(0.062)	0.1218**	(0.061)
Low-skilled Father	-0.0119	(0.020)				
High-skilled Father	0.0433	(0.032)				
Low-skilled Mother	-0.0305*	(0.016)				
High-skilled Mother	-0.0385	(0.047)				
IND2	0.0398	(0.037)			0.0441	(0.037)
IND3	0.0538	(0.036)			0.0581*	(0.035)
IND4	0.1283***	(0.037)			0.1336***	(0.037)
IND5	0.0964*	(0.055)			0.1349***	(0.046)
Female $\times$ IND5	0.1025	(0.064)				
Immigrant $\times$ IND5	-0.1398	(0.105)				
Constant	1.8901***	(0.160)	2.0923***	(0.038)	1.9815***	(0.052)
Observations	3224		3224		3224	
Adjusted R^2	0.251		0.244		0.250	

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$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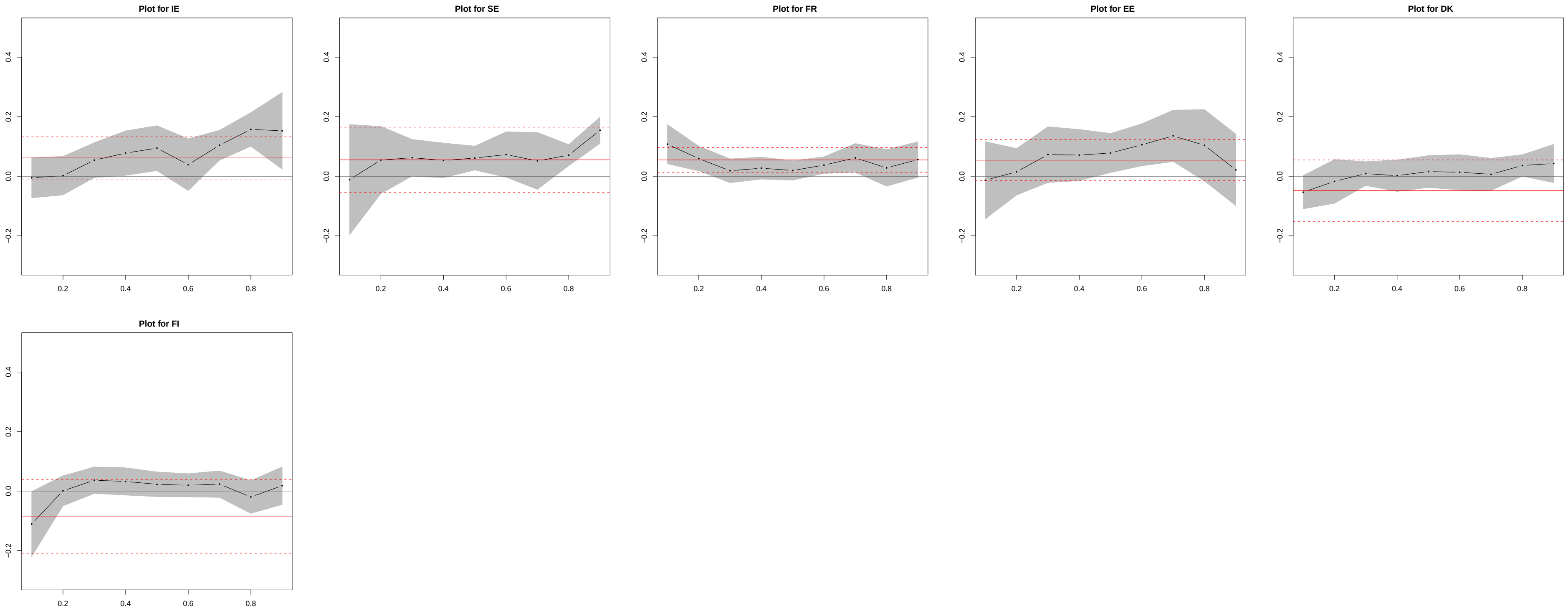

Figure A.1: Quantile Regression Results for Deciles

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